

**DETAILED ACTION**

***Status of Claims***

1. Claims 1-34, filed August 18<sup>th</sup>, 2009 are pending.

***Acknowledgement of RCE***

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 18<sup>th</sup>, 2009 has been entered.

***Status of Previous Rejections***

3. The previous rejection of claims 1-34 under 35 U.S.C. 103(a) over WO '724 in view of CA '783, WO '788, and Kanari in the Office action dated February 20<sup>th</sup>, 2009 are maintained.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

***Claim Rejections - 35 USC § 103***

4. **Claims 1-34** are rejected under 35 U.S.C. 103(a) as being unpatentable over **WO '724** (Lalancette et al, WO 97/46724) in view of **CA '783** (Lalancette et al, CA 2,193,783), **WO '788** (Lalancette, WO 02/053788), and **Kanari** (N Kanari et al, A study

of chromite carbochlorination kinetics, *Metallurgical and Materials Transactions B*, Vol. 30B, (August 1999), p. 577-587).

WO '724

WO '724, drawn to a process for obtaining chromium-rich chromite, teaches that chlorine is a very selective reagent for the recovery of platinoids (PGM), leaving most of the chromite unaltered (p. 3, line 20 to p. 4, line 1) and that by adjusting appropriate operating conditions and in the presence of NaCl, iron oxide in chromite can be oxidized to hematite, thus increasing the Cr/Fe ratio in the residual insoluble chromite. The resultant hematite is readily soluble in HCl and can be thus be removed by acid washing, along with the soluble ferric chloride ( $\text{FeCl}_3$ ) formed during chlorination (p. 4, lines 9-14).

The ore is dry chlorinated at a temperature of between 400 and 750°C in the presence of NaCl (p. 5, lines 3-7 and 13-15). The temperature of the dry chlorination step is a result effective variable depending on the refractoriness of the ore under treatment and the capacity of treatment of a given apparatus (p. 7, line 15 - p. 9, line 5).

The reaction time is 0.5 to 2 hours, depending on the nature of the ore, the degree of completion desired, the temperature used, and the granulometry of the ore (p. 9, lines 10-14).

WO '724 does not teach does not teach the recovery of PGM metals nor the use of CO gas.

CA '783

CA '783, drawn to a process for recovering platinum group metals (PGM) from PGM-bearing chromite ores or concentrates (p. 1, lines 5-7), teaches the dry chlorination of chromite in the presence of NaCl at a temperature of between 350 and 800°C (p. 5, line 16-23).

The advantage of this PGM recovery process is that PGM recovery is 10 to 20% higher than pyrometallurgical methods, osmium is recovered much more effectively, and is modular and thus less capital intensive than pyrometallurgical processes (p. 6, line 23 to p. 7, line 8).

The chlorination temperature is a result effective variable depending on the type of ore and must be high enough to ensure desired reactions with PGM but low enough to avoid detrimental reactions with equipment and side reactions with chromite (p. 8, lines 10-24).

The addition of NaCl produces soluble chlorides with some of the PGM that would otherwise give insoluble chlorides (p. 11, lines 5-15).

WO '788

WO '788, drawn to a method for the recovery of various metals, including precious metals, from fresh ore, mine tailings and industrial waste in one type of operation (p. 3, lines 1-5).

WO '788 further expands on the salt concentration taught in WO '724 and CA '783 in teaching that it is necessary to have a source of chloride ions, normally, NaCl, present in the reaction mixture so as to have the available in situ chloride ion concentration required for the solubilisation at the time of leaching, upon completion of

the chlorination step (p. 6, lines 10-17). KCl or CaCl<sub>2</sub> could also be used as salts (p. 6, lines 17-18). The salt content should be about 5 wt% (p. 10, lines 12-21).

Kanari:

Kanari, drawn to the study of carbochlorination of chromite concentrate to increase its Cr/Fe ratio through selective chlorination of the iron compounds (p. 577, col. 1, para 2 to col. 2, para 1). Previous research had suggested that carbochlorination reaction rate decreases at temperatures above 800°C due to the decomposition of COCl<sub>2</sub> formed in situ.

The phase stability diagrams of (Cr, Fe, Mg, Al, Si) - O - Cl systems suggested that chlorides were the stable phases during chlorination of oxides in the presence of a reducing atmosphere, (p. 579, col. 2). Using carbon monoxide as the reducing atmosphere permits the volatilize of Si, Al, and Fe chlorides leading to a residue rich in chromium compounds (p. 580, col. 1, para 1-2).

Figures 8a and 8b teach the dependence of the iron and chromium recovery on the carbochlorination temperature and reaction time (p. 581).

Figure 11 teaches the effect of gas flow rate on the carbochlorination of chromite at 1000°C and suggests that gas flow rates of about 60 L/h (1000 mL/min) maximize the reaction rate (p. 583).

Lastly Kanari teaches that the maximum reaction rate was for a gas mixture with an almost equimolar Cl<sub>2</sub> and CO content (Cl<sub>2</sub>/CO ratio of ~1, p. 585, col. 2, para 2).

Regarding claim 1, it would have been obvious to one of ordinary skill in chromite metallurgy, at the time the invention was made, taking the disclosures of WO '724, CA

'783, WO '788, and Kanari as a whole, to modify the process of WO '724 to include the recovery of PGM as taught by CA '783 and WO '788 using a salt content to convert at least one PGM into a corresponding PGM chloride salt, and contacting the mixture with Cl<sub>2</sub> gas (as taught by WO '727, CA '783, and WO '788) and CO (as taught by Kanari) to recover said PGM chloride salt(s) for the following reasons:

WO '724 taught the general process of upgrading chromite ore by chlorination and referenced CA '783 which taught that this same process recovers selectively recovers PGM, thus motivation comes from WO '724 suggestion that the same chlorination process in the presence of NaCl both upgrades chromite to increase the Cr/Fe ratio and recovers PGM metals. CA '783, along with WO '788 go into further detail describing the use of the salt as it renders otherwise insoluble PGM metals such as iridium soluble (CA '783) and adds chloride ions to the solution to increase recovery (CA '783 and WO '788). Finally Kanari teaches the use of CO in addition to Cl<sub>2</sub> gas in that CO produces a reducing atmosphere and permits the volatilize of Si, Al, and Fe chlorides leading to a residue rich in chromium compounds (p. 580, col. 1, para 1-2).

With respect to at least one species of PGM being converted into a *solid material containing* a corresponding PGM chloride salt, both WO '724 (p. 4, lines 1-8 and p. 5, lines 13-15) and CA '783 (p. 5, lines 20-25, particularly p. 11, lines 5-17) add NaCl while chlorinating chromite and that CA '783 specifically teaches that the addition of such salt facilitated soluble (stable) chlorides with some of the PGM that would have otherwise formed insoluble chloride. In particular, CA '783 teaches after chlorination and removing the volatile gases to a condensing tower, the solid left in the dry chlorinator is

dumped into a digester where complete solution (dissolution) of PGM is obtained over one to several hours, thus the solid referred to inherently contains solid PGM chloride salts. From MPEP 2112: "[T]he PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product. Whether the rejection is based on 'inherency' under 35 U.S.C. 102, on '*prima facie* obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same."

Regarding claims 2-10, WO '724 teaches that the temperature of the dry chlorination step is a result effective variable depending on the refractoriness of the ore under treatment and the capacity of treatment of a given apparatus (p. 7, line 15 - p. 9, line 5). Furthermore, CA '783 teaches that the chlorination temperature is a result effective variable depending on the type of ore and must be high enough to ensure desired reactions with PGM but low enough to avoid detrimental reactions with equipment and side reactions with chromite (p. 8, lines 10-24). Finally Kanari, in figures 8a and 8b on p. 581, teaches the dependence of the iron and chromium recovery on the carbochlorination temperature and reaction time. It would have been obvious to one of ordinary skill in the art at the time of the invention to choose the instantly claimed ranges through process optimization, since it has been held that there the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. See In re Boesch, 205 USPQ 215 (CCPA 1980). MPEP 2144.05, para I states: "In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists."

Regarding claim 11, Kanari, in Figure 11, teaches the effect of gas flow rate on the carbochlorination of chromite at 1000°C and suggests that gas flow rates of about 60 L/h (1000 mL/min) maximize the reaction rate (p. 583). It would have been obvious to one of ordinary skill in the art at the time of the invention to choose the instantly claimed ranges through process optimization.

Regarding claims 12 and 13, WO '724 (p. 5, lines 3-7 and 13-15), CA '783 (p. 11, lines 5-15), and WO '788 (p. 6, lines 17-18), teach the use of NaCl.

Regarding claims 14 and 15, WO '788 teaches that it is necessary to have a source of chloride ions, normally, NaCl, present in the reaction mixture so as to have the available in situ chloride ion concentration required for the solubilisation at the time of leaching, upon completion of the chlorination step (p. 6, lines 10-17) and that the salt content should be about 5 wt% (p. 10, lines 12-21). MPEP 2144.05, para I states: "In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists."

Regarding claim 16, the subject matter of this claim would have been obvious to one of ordinary skill in chromite metallurgy, taking the disclosures of WO '724, CA '783, WO '788, and Kanari as a whole, for the same reasons as applicable to claim 1 supra. With respect to the amendment to claim 16 adding that gaseous FeCl<sub>3</sub> (ferric chloride) is formed, both CA '293 and WO '724 in Fig. 1 shows that volatiles of the form M<sub>x</sub>Cl<sub>y</sub> are removed from the dry chlorinator and condensed and FeCl<sub>3</sub> was recovered in the condenser as acid soluble ferric chloride, which suggests that gaseous (volatile FeCl<sub>3</sub>) was formed during the reaction of chromite ore with Cl<sub>2</sub>. In addition, WO '724 taught

that the chromite ore is dry chlorinated at a temperature of between 400 and 750°C in the presence of NaCl (p. 5, lines 3-7 and 13-15) whereas one of ordinary skill would know that ferric chloride ( $\text{FeCl}_3$ ) boils at approximately 315°C, and thus at least some gaseous  $\text{FeCl}_3$  would be formed during the reaction. Lastly, Kanari taught that carbochlorination of chromite compounds at temperatures close to 500°C permits the volatilization of chlorides such as  $\text{FeCl}_3$  (p. 580, col. 1, para 1-2) and Fig. 7 (p. 580, col. 1) shows the high vapor pressure of  $\text{FeCl}_3$  which rises quickly around the 300°C mark, consistent with an observed boiling point of about 315°C when the vapor pressure reaches atmospheric pressure. Again, from MPEP 2112: "[T]he PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product. Whether the rejection is based on 'inherency' under 35 U.S.C. 102, on '*prima facie* obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same."

Regarding claims 17-20, WO '724 (p. 5, lines 3-7 and 13-15), CA '783 (p. 11, lines 5-15), and WO '788 (p. 6, lines 17-18), teach the use of NaCl. WO '788 teaches that it is necessary to have a source of chloride ions, normally, NaCl, present in the reaction mixture so as to have the available in situ chloride ion concentration required for the solubilisation at the time of leaching, upon completion of the chlorination step (p. 6, lines 10-17) and that the salt content should be about 5 wt% (p. 10, lines 12-21). MPEP 2144.05, para I states: "In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists."

Regarding claims 21 and 22, Kanari, in Figure 11, teaches the effect of gas flow rate on the carbochlorination of chromite at 1000°C and suggests that gas flow rates of about 60 L/h (1000 mL/min) maximize the reaction rate (p. 583). It would have been obvious to one of ordinary skill in the art at the time of the invention to choose the instantly claimed ranges through process optimization.

Regarding claims 23 and 24, WO '724 teaches that the temperature of the dry chlorination step is a result effective variable depending on the refractoriness of the ore under treatment and the capacity of treatment of a given apparatus (p. 7, line 15 - p. 9, line 5). Furthermore, CA '783 teaches that the chlorination temperature is a result effective variable depending on the type of ore and must be high enough to ensure desired reactions with PGM but low enough to avoid detrimental reactions with equipment and side reactions with chromite (p. 8, lines 10-24). Finally Kanari, in figures 8a and 8b on p. 581, teaches the dependence of the iron and chromium recovery on the carbochlorination temperature and reaction time. It would have been obvious to one of ordinary skill in the art at the time of the invention to choose the instantly claimed ranges through process optimization.

Regarding claims 25 and 30, Kanari teaches that the maximum reaction rate was for a gas mixture with an almost equimolar Cl<sub>2</sub> and CO content (Cl<sub>2</sub>/CO ratio of ~1, p. 585, col. 2, para 2).

Regarding claims 26 and 31, WO '724 (p. 7, lines 12-15) and CA '783 (p. 8, lines 5-7) teach that the mixture is dried before chlorination.

Regarding claims 27 and 32, WO '724 (p. 9, lines 3-6) and CA '783 (p. 9, lines 16-19) teach the use of nitrogen as a carrier gas.

Regarding claims 28-29 and 33-34, WO '724 teaches that the reaction time is 0.5 to 2 hours, depending on the nature of the ore, the degree of completion desired, the temperature used, and the granulometry of the ore (p. 9, lines 10-14). MPEP 2144.05, para I states: "In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists."

***Response to Applicant's Arguments:***

5. Applicant's arguments filed August 18<sup>th</sup>, 2009 have been fully considered but they are not persuasive.

Applicants assert (p. 8, para 3) that FeCl<sub>3</sub> is only produced by WO '724 and CA '783 during the chlorine neutralization step and FeCl<sub>3</sub> is not produced during the reaction of chromite ore with Cl<sub>2</sub>.

In response, WO '724 teaches that the action of chlorine on chromite produces FeCl<sub>3</sub> (p. 4, lines 6-8 and 10-13) "acid soluble ferric chloride formed during chlorination...", not that FeCl<sub>3</sub> is produced by neutralization. CA '783, based on a substantially similar process as compared to WO '724, teaches that at least some iron in the chromite is converted to soluble chlorides during chlorination (p. 9, lines 10-15).

Applicants assert (p. 8, para 4 to p. 10) that the prior art teaches away from using carbochlorination to extract PGM from chromites.

In response, the cited prior art relied upon in the instant rejections does not teach away from carbochlorination, in particular Kanari taught that using carbon monoxide as the reducing atmosphere permits the volatilize of Si, Al, and Fe chlorides leading to a residue rich in chromium compounds (p. 580, col. 1, para 1-2) and that volatilization of the reaction products is achieved by using temperatures higher than 800 °C (Abstract), a temperature range explicitly avoided by the instant claims. Furthermore, the instant claims do not prohibit volatilization of PGM concentrates, they only require that "at least one species of PGM" be converted to a solid species, and there is no restriction as to the yield or amount of volatilization. The instant claims only require that one element of the PGM series be recovered as a solid.

Lastly, Applicants assert (p. 11, para 2-4) unpredictable advantages in that the presence of CO results in the formation of a NaCl-FeCl<sub>3</sub> system containing NaFeCl<sub>4</sub>.

In response, the presence in NaFeCl<sub>4</sub> is not reflected in the instant claims and the cited prior art would be reasonably expected to have such a catalytic melt as the cited prior art combination teaches NaCl salt reacting with Fe containing chromites with CO and Cl<sub>2</sub> present.

### ***Conclusion***

- Claims 1-34 are rejected
- No claims are allowed

The rejections above rely on the references for all the teachings expressed in the texts of the references and/or one of ordinary skill in the metallurgical art would have reasonably understood or implied from the texts of the references. To emphasize certain aspects of the prior art, only specific portions of the texts have been pointed out.

Art Unit: 1793

Each reference as a whole should be reviewed in responding to the rejection, since other sections of the same reference and/or various combinations of the cited references may be relied on in future rejections in view of amendments.

All recited limitations in the instant claims have been met by the rejections as set forth above. Applicant is reminded that when amendment and/or revision is required, applicant should therefore specifically point out the support for any amendments made to the disclosure. See 37 C.F.R. § 1.121; 37 C.F.R. Part §41.37 (c)(1)(v); MPEP §714.02; and MPEP §2411.01(B).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mark L. Shevin whose telephone number is (571) 270-3588 and fax number is (571) 270-4588. The examiner can normally be reached on Monday - Friday, 8:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy M. King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

*/Mark L. Shevin/  
Examiner, Art Unit 1793*

October 20th, 2009  
10-564,735

*/George Wyszomierski/  
Primary Examiner  
Art Unit 1793*